

National Aeronautics and Space Administration

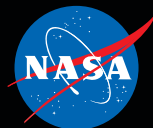


# Destination Station

exhibit resources



[www.nasa.gov](http://www.nasa.gov)



## welcome to destination station

The International Space Station is a high-flying, international research laboratory that supports a wide range of scientific inquiry in biology, human physiology, physical, material, Earth and space sciences. During the last 11 years, fifteen countries worked together to complete assembly on the largest engineering feat ever achieved. The orbiting laboratory provides the interior volume of a five-bedroom house, equipped with premier research capabilities, living quarters and a 360 degree window on the world. From end to end, the space station is longer than an American football field and accommodates up to six astronauts at a time. Knowledge gained through space research conducted aboard the space station has led to improvements in life on Earth and prepares us for future exploration.

This guide is designed to help you, as educators, bring YOUR Space Station to the classrooms.

### **Destination Station Online**

[http://www.nasa.gov/mission\\_pages/station/news/destination\\_station.html](http://www.nasa.gov/mission_pages/station/news/destination_station.html)





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## assembly

The International Space Station, commonly referred to as the space station, is one of the greatest technological, political and engineering accomplishments in human history. The completion of the space station on-orbit assembly, allows for a focus on the purpose of the space station: one of exploration, scientific research, technology development, and education. The pursuits of knowledge will teach us about living and working in space as well as improve life here on Earth.

The assembly of the space station is an amazing accomplishment in itself. Pieces of the space station were built around the world, joined together in space and have been used as the most advanced laboratory ever imagined. And it's travelling at 5 miles a second, 250 miles above the earth. Talk about a science lesson.

### **"Assemble" this thought:**

What do you think is the biggest challenge in building the space station? Would it be the actual construction? Budget and planning? Partnering with other countries? Try to think of a time in history when the human race came together for a common goal. What were the outcomes? How does this new era of cooperation affect your life?

### **If you Build it.....**

Learn about and build your own version of this amazing laboratory.



**Build the Station Simulation - Educator's Guide:** [http://www.nasa.gov/directorates/heo/education/ISS\\_workbook.html](http://www.nasa.gov/directorates/heo/education/ISS_workbook.html)

**International Space Station Laboratories Interactive:** [http://www.nasa.gov/externalflash/lab\\_racks/labs.html](http://www.nasa.gov/externalflash/lab_racks/labs.html)



## assembly



*First 3 modules of the station connected in space.*

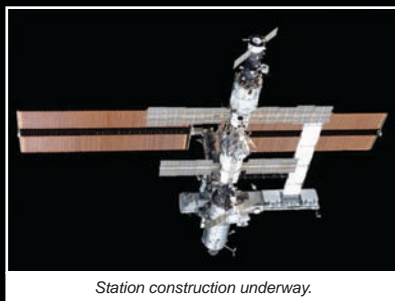
### Be amazed:

Check out how Newton's Laws work perfectly in space. If only Sir Isaac could see it.

**How orbits work:** <http://spaceplace.nasa.gov/how-orbits-work/en/>

### Once it's up there...

How does the space station stay in orbit? Why doesn't it fall out of the sky? Check this video out to discover that Newton really was right.



*Station construction underway.*

**Launchpad: Newton's Laws On-Board the International Space Station:** <http://www.nasa.gov/audience/foreducators/nasaclips/search.html?terms=&category=0010>



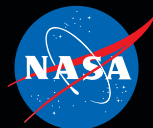
*Station assembly complete.*

### Put the Pieces Together:

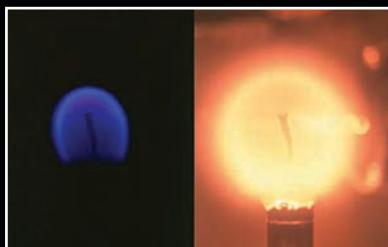
**What is the International Space Station?** <http://www.nasa.gov/audience/forstudents/5-8/features/what-is-the-iss-58.html>

**Did you know astronauts recycle water in space?** [http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Did\\_You\\_Know\\_Astronauts\\_Will\\_Recycle\\_Water.html](http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Did_You_Know_Astronauts_Will_Recycle_Water.html)

**ISS Interactive Reference Guide:** <http://www.nasa.gov/externalflash/ISSRG/>



## research



*Combustion experiment comparing flames on Earth and in microgravity.*

The Space Station is THE fast-flying, high-tech, advanced laboratory that every science teacher dreams about. It's a technically sophisticated facility that surpasses anything here on Earth and can support a wide range of scientific inquiry in biology, human physiology,

physical and material sciences, and Earth and space sciences. This lab is the size of a U.S. football field (including the end zones) and the interior volume of 1.5 Boeing 747 jetliners.

The station crew's main purpose is to conduct research, take part in medical experiments and maintain the station. Each Expedition crew has its hands full with new and continuing experiments. Each lab module houses several experiments researching bioastronautics, spaceflight, physical and Earth sciences, space biology, and space product development where every day is a good day to be a scientist.



*Astronaut Bill McArthur with microgravity Glove Box.*



*Astronaut Sunita Williams works on a biological detection system developed for the space station.*



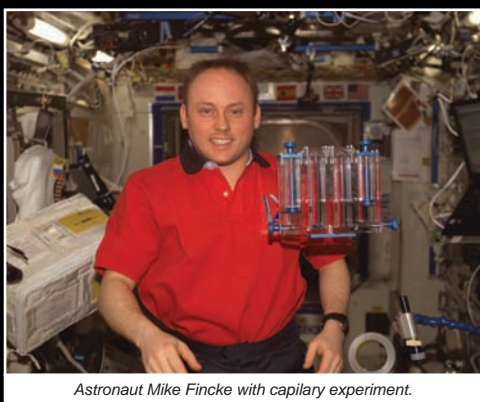


## research

Got something to say? 250 miles up, and you still have a signal!

Investigate how we communicate with our spacecraft and how research on the space station has led to devices like cell phones and GPS. This video shows how we talk to space using a variety of technological advances.

**Communications and Launch NASA eClips Video:** <http://www.nasa.gov/audience/foreducators/nasaclips/launchpad/communications.html>



*Astronaut Mike Fincke with capillary experiment.*

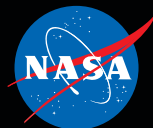
You be the researcher...

The Space Station is made for science, so what exactly do they do up there? Whether its combustion science in space, crystals in the Columbus module or defying gravity in the Destiny Lab, NASA

crewmembers are experts in the Scientific Method. Now it's your turn.

**Microgravity Educator's Guide:** [http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Microgravity\\_Teachers\\_Guide.html](http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Microgravity_Teachers_Guide.html)

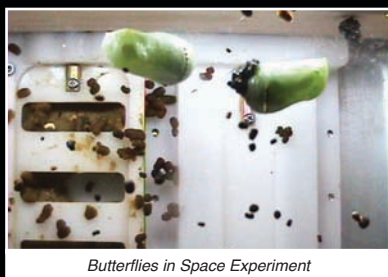
**Conjuring Crystals:** [http://science.nasa.gov/science-news/science-at-nasa/2001/ast11dec\\_1/](http://science.nasa.gov/science-news/science-at-nasa/2001/ast11dec_1/)



## health & life science

Space exploration places great demands on crewmembers, both on their bodies and their minds. Humans involved in space flight must remain healthy and still be able to perform their job. Furthermore, when space explorers return to Earth they must be capable of healthy and productive lives. NASA works very hard at understanding how the human body works in space and tries to understand how we can help crewmembers recover after a long stay on the station.

The Space Station provides an opportunity to examine human health in a way that cannot be done on Earth. Crews face physiological changes that can be reproduced by an experiment. So, that little experiment that your students did in science class - it could be done on the station.



*Butterflies in Space Experiment*

### Understanding all forms of life in space

NASA recently put some new crewmembers in orbit. Check out these experiments with spiders and butterflies. These are sure to be of interest to you and your students.

**Spiders in Space – Live!:** [http://www.nasa.gov/mission\\_pages/station/research/news/space\\_spiders\\_live.html](http://www.nasa.gov/mission_pages/station/research/news/space_spiders_live.html)

**Butterflies in Space:** <http://www.nsbri.org/EDUCATION-and-TRAINING/Teaching-Resources/Middle-School/Butterflies-in-Space/>



*Spiders in Space Experiment*





## health & life science

### YOU be the experiment

Microgravity has its effects on the human body as well. Long term effects include loss of muscle mass, calcium loss, and changes in blood pressure. The following lesson plans will give you an idea of what it is like to be a human experiment onboard the space station.

Take care of yourself, eat right, and exercise. Just like they taught you in school.

**Space Food and Nutrition Educator Guide:** [http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Space\\_Food\\_and\\_Nutrition\\_Educator\\_Guide.html](http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Space_Food_and_Nutrition_Educator_Guide.html)

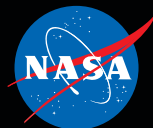
**The Science of Food and Fitness:** [http://www.nsbri.org/default/Documents/EducationAndTraining/MiddleSchool/Food/TSO\\_Food\\_guide.pdf](http://www.nsbri.org/default/Documents/EducationAndTraining/MiddleSchool/Food/TSO_Food_guide.pdf)

**The Science of Sleep and Daily Rhythms:** <http://www.nsbri.org/EDUCATION-and-TRAINING/Teaching-Resources/Middle-School/Sleep-and-Daily-Rhythms/>

**The Science of Heart and Circulation:** <http://www.nsbri.org/EDUCATION-and-TRAINING/Teaching-Resources/Middle-School/Heart-and-Circulation/>

**Muscles & Bones:** <http://www.nsbri.org/EDUCATION-and-TRAINING/Teaching-Resources/Middle-School/Muscles-and-Bones/>

**The Brain in Space: A Teacher's Guide:** <http://www.nsbri.org/EDUCATION-and-TRAINING/Teaching-Resources/Middle-School/The-Brain-in-Space/>



## living & working in space



*Astronauts Ron Garan and Mike Fossum speak live to students.*

The International Space Station is unique, because people are actually living – and working –in space 24 hours a day, seven days a week, 365 days a year. On board the Space Station, astronauts wear the usual clothing they would wear on Earth, but have special engineered pressurized suits for space walks. The space station is equipped with special microwave ovens and refrigerators, so the astronauts eat some of the same food we do, including specially-packaged fruits and ice cream. Without the force of gravity, daily exercise is very important on the space station, since microgravity affects bones and muscles in space. As with any home or living area, crewmembers are also responsible with tasks that help maintain the station. The space station is the home of six full-time crewmembers, and is made up of astronauts and cosmonauts from nations around the world.

Working in a dangerous and hostile environment while orbiting the Earth at 17,500 miles per hour, the space station was carefully assembled by spacewalking astronauts and robotic arm operators. Now that it is complete, the space station stands as one of the most shining examples of human ingenuity.



## living & working in space

### Space “walk” in their Shoes

Spend time like an astronaut by looking through real on-orbit footage taken by the crewmembers themselves and check out how they walk in space with these interactive below.

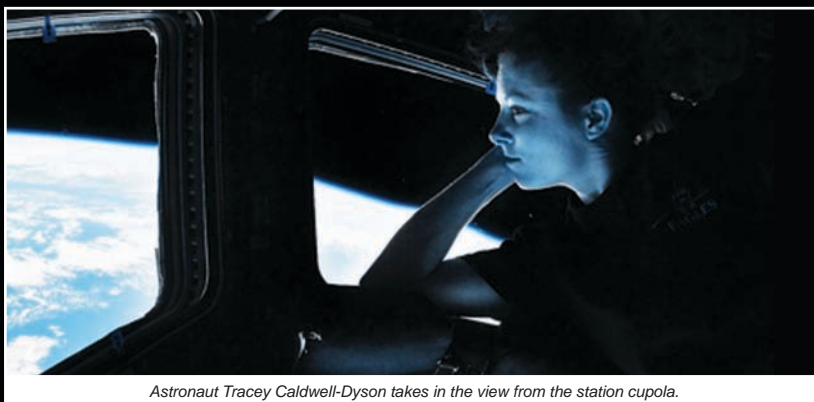
#### **Day in the Life Aboard the International Space Station:**

[http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Space\\_Food\\_and\\_Nutrition\\_Educator\\_Guide.html](http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Space_Food_and_Nutrition_Educator_Guide.html)

**Station Spacewalk Game:** [http://www.nasa.gov/multimedia/3d\\_resources/station\\_spacewalk\\_game.html](http://www.nasa.gov/multimedia/3d_resources/station_spacewalk_game.html)

### Think about it

What kind of issues do you think you would have if you were in space for a long time? Would you miss your family and friends? Would it be difficult for you to not be able to go outdoors? How would you feel about very small living quarters and not much privacy? What would you do in your free time? What would your thoughts be?



*Astronaut Tracey Caldwell-Dyson takes in the view from the station cupola.*



## earth observation

From high above, the Earth can be seen in a whole new perspective. The space station offers a unique view to study our weather, landforms, vegetation,



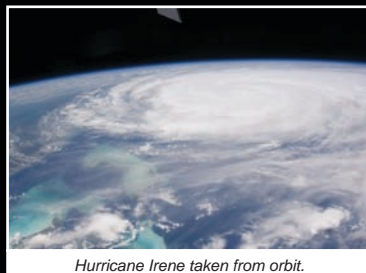
*Nukuoro Atoll, Federated States of Micronesia.*

oceans and atmosphere. By observing the Earth from space, we can learn essential information about the past and future of our planet. Astronauts on the station take daily pictures of the Earth to help us learn about how people affect our planet, as well as how the Earth's surface is changing through erosion, tectonic activity, flooding and fires. The Theory of Plate Tectonics is alive and well below.

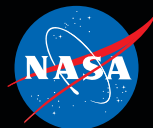
The proof is in the pictures and it is a breathtaking view.



*Man-made islands on Dubia from space.*



*Hurricane Irene taken from orbit.*



## earth observation

### Our Home: From Above

**Visible Earth:** <http://visibleearth.nasa.gov/>

**EarthKAM Resources:**  
<https://earthkam.ucsd.edu/resources>

### NASA Earth

**Observatory:** <http://earthobservatory.nasa.gov/>



*Glimpse of the barren moon through the Earth's limb.*

**The Gateway to Astronaut Photography of Earth:**  
<http://eol.jsc.nasa.gov/>



*Eruption of Cleveland Volcano, Aleutian Islands, Alaska.*

**Earth Science at your Fingertips:**

**Blue Marble Matches: Using Earth for Planetary Comparisons:**  
<http://ares.jsc.nasa.gov/ares/eeab/BMM.cfm>

**Living with a Star:**  
<http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Living.with.a.Star.html>

[gov/audience/foreducators/topnav/materials/listbytype/Living.with.a.Star.html](http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Living.with.a.Star.html)



## spinoffs

Believe it or not, the cell phone you use every day is part of the plethora of devices NASA has developed or improved. This includes everything from smoke detectors to athletic footwear to the GPS in your car – NASA did the hard work for you and now it is at your fingertips.

### **NASA Spinoffs in your everyday life**

Check out all the things NASA has touched in your house and in your town. These interactive websites give students a chance to see how NASA's dollars are used to improve life here on Earth for the human race.

#### **NASA in Your Home and City:**

<http://www.nasa.gov/externalflash/nasacity/index2.htm>

#### **NASA Aeronautics Research Onboard:**

[http://www.aeronautics.nasa.gov/aero\\_onboard/flash\\_index.html](http://www.aeronautics.nasa.gov/aero_onboard/flash_index.html)

#### **NASA's Wheel of Spinoffs Game:**

<http://www.nasa.gov/externalflash/Spinoffs-web/index.html>

#### **Spinoffs That Rock!:**

[http://www.nasa.gov/audience/forstudents/k-4/home/spinoffs\\_feature\\_k\\_4.html](http://www.nasa.gov/audience/forstudents/k-4/home/spinoffs_feature_k_4.html)





## spinoffs

**NASA Spinoff Publication: Value to NASA, Benefits for the Nation:** <http://www.sti.nasa.gov/tto/Spinoff2010/>

**Spinoff Flyers and Brochure Series:**  
<http://www.sti.nasa.gov/tto/flyers.html>

**NASA Solutions: Benefits of the Space Program:**  
[http://techtran.msfc.nasa.gov/at\\_home.html](http://techtran.msfc.nasa.gov/at_home.html)



Spinoff Flyers and Brochure Series



## opportunities for students

NASA prides itself on providing real-world, life-changing experiences to students year round. Check out these awesome opportunities for your students to interact with the Space Station!



*Astronaut Sandy Magnus makes a radio contact with students.*

### Amateur Radio on the International Space Station – ARISS

Using amateur radio, students from around the world can ask astronauts questions about life in space and other space-related topics. Students are fully

engaged in the ARISS contact by helping set up an amateur radio ground station at their school.

<http://www.nasa.gov/audience/foreducators/teachingfromspace/students/ariss.html>

### In-flight Education Downlinks

Wouldn't it be great if students could talk with an astronaut or cosmonaut on the International Space Station and ask them a question about their studies? Well, they can! Your school or education organization can host an In-flight Education Downlink with space station crewmembers – LIVE!

<http://www.nasa.gov/audience/foreducators/teachingfromspace/students/downlinks.html>



## opportunities for students

### DIY Podcast

Are you looking for a new approach to engage students in science, technology, engineering and mathematics? NASA provides a set of audio and video clips along with links to images and information about a STEM-related topic. Students can choose as many items as they want to include in a project and download them to their computer.

<http://www.nasa.gov/audience/foreducators/diypodcast/index.html>

### Environmental Control and Life Support Systems Water Filtration Challenge Educator Guide

[http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Water\\_Filtration\\_Challenge.html](http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Water_Filtration_Challenge.html)

### Digital Learning Network (DLN)

Live interactive educational expeditions, design challenges and virtual visits by NASA employees through video conference.

<http://dln.nasa.gov>

### EarthKAM

Students take photographs of Earth by using the Internet to direct a digital camera on the International Space Station. They pick the place and control the camera. It doesn't get any more "hands on" than this.

<http://www.earthkam.ucsd.edu/>

### Student Employment at NASA

Want to work for NASA? Here's where you start.

<http://nasajobs.nasa.gov/studentopps/employment/programs.htm>



## resources for educators

Don't worry, we didn't forget about the you, the teachers. NASA has a plethora of resources, educator guides, lesson plans and activities to help support your "mission" of preparing the next generation.

**Spacesuits & Spacewalking:** <http://www.nasa.gov/education/spacesuits>

**Robotics:** <http://www.nasa.gov/education/robotics>

**Rocketry:** <http://www.nasa.gov/education/rocketry>



*Space Station in 2011 – Construction Complete*

### Educator Resource Center Network (ERCN)

The purpose of a NASA Educator Resource Center (ERC) is to help teachers learn about

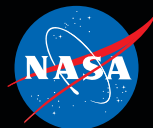
and use NASA's educational resources. Personnel at ERCs located throughout the United States work with teachers in their regions to share NASA's expertise.

[http://www.nasa.gov/audience/foreducators/k-4/learning/F\\_Educator\\_Resource\\_Center\\_Network.html](http://www.nasa.gov/audience/foreducators/k-4/learning/F_Educator_Resource_Center_Network.html)

### Teaching From Space

We are a team of former classroom teachers devoted to helping educators make science, technology, engineering and mathematics, or STEM, come alive for learners.

[www.nasa.gov/education/tfs](http://www.nasa.gov/education/tfs)



## opportunities for educators

### Reduced Gravity Flight Opportunity

Experience weightlessness on NASA's Reduced Gravity aircraft! This is your opportunity to work with a team to



*Teacher performs her experiment on a Reduced Gravity flight.*

propose, design, fabricate and fly a reduced-gravity experiment. This opportunity is available for all K-12 educators.

<http://microgravityuniversity.jsc.nasa.gov/tfs/>

### NASA Explorer Schools

Participants have access to NASA opportunities and are recognized for innovative use of NASA educational resources and demonstration of best practices in STEM education.

<http://www.nasa.gov/offices/education/programs/national/nes2/home/index.html>



## more NASA resources

**NASA Portal:** The NASA Portal serves as the gateway for information regarding content, programs, and services offered by NASA for the general public and specifically, for the educational community (*Also in Spanish*): [www.nasa.gov](http://www.nasa.gov)

**Space Center Houston Education Office:** Information available on field trips, day camps, scout programs, space school, and distance learning. For information call 281-244-2142; for reservations call 281-283-4755, or check the Space Center Houston web site <http://www.spacecenter.org>.

**Johnson Space Center Education Homepage:** Johnson Space Center offers a wide variety of programs for students and educators. Information and resources are found at: <http://education.jsc.nasa.gov>

**JSC Education Outreach Program:** To request a NASA or NASA affiliated employee to speak at a school (K - 12) within fifty miles of JSC, visit <http://education.jsc.nasa.gov/outreach> and select Education Outreach Program. 281-483-8712. Six weeks notice preferred.

**Astronaut Office:** To arrange for an astronaut appearance, at least eight to ten weeks notice is required, write to [jsc-astroapp@mail.nasa.gov](mailto:jsc-astroapp@mail.nasa.gov) or visit <http://www.nasa.gov/about/speakers/astonautappearances.html>, or call 281-244-8866. To request an astronaut photo, phone 281-244-8871.





## more NASA resources

**Space Shuttle Thermal Protection System:** Schools may borrow shuttle tiles. For information write to: Johnson Space Center, Mail Code JB, 2101 NASA Parkway, Houston, TX 77058.

**JSC Traveling Exhibits:** Johnson Space Center operates a traveling exhibits program in its eight state region. For information write to:

Louis A. Parker, Exhibits Manager  
AP 161 Office of Public Affairs  
NASA Johnson Space Center  
2101 NASA Parkway  
Houston, TX 77058-3696

Please be sure to visit the exhibit web site at <http://www.nasa.gov/centers/johnson/events/exhibits/index.html>. If you are outside the Johnson Space Center region, you may contact the Educator Resource Center at your region's NASA field center for information.

**Aerospace Education Services Project (AESP):** The AESP staff provides no cost professional development for K-12 educators through classroom demonstration, distance learning, and in-service training. Detailed information, points of contact and on-line request form at: <http://aesp.psu.edu>

**NASA Images:** Twenty-one collections of NASA images have been coordinated into one searchable directory of universe, solar system, earth, and astronauts. <http://www.nasaimages.org/>



## more NASA resources

**Earth From Space:** Earth from Space provides several ways to search the selected images. Each image is available in three resolutions and includes cataloging data and a caption. <http://earth.jsc.nasa.gov/sseop/efs/>

**Starchild:** Site for K-8 students with information on the solar system and space travel. Information, games, and activities are found at <http://starchild.gsfc.nasa.gov>. (For 9-12 students <http://imagine.gsfc.nasa.gov>).

**Space Telescope Science Institute (STSI):** The STSI has information on and pictures from the Hubble Space Telescope. Educational materials and activities are available at [www.stsci.edu](http://www.stsci.edu).

**NASA Science Directory:** Site links researchers, educators, students, and citizen scientists to news and resources (content/lessons) for space science, earth science, sun, planets, and astrophysics at <http://science.nasa.gov/>.

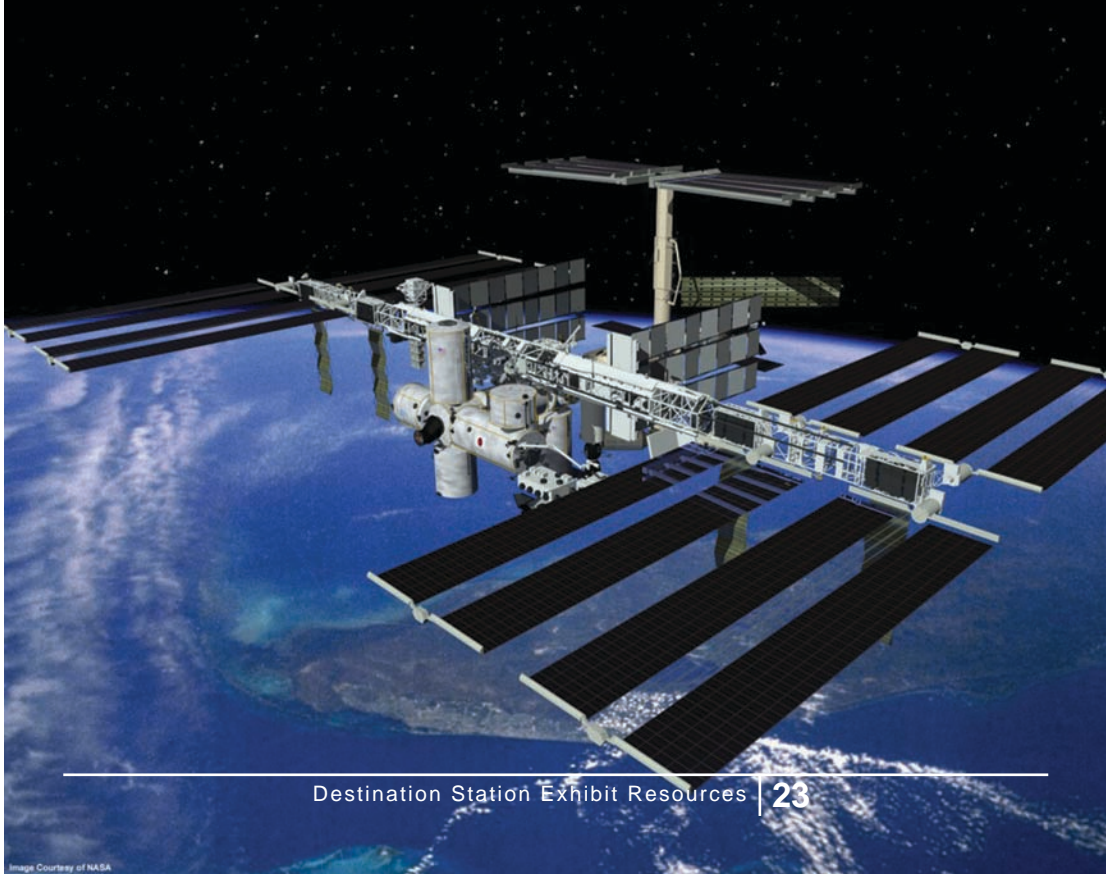
**S'COOL:** S'COOL is an international project in which students observe clouds, report data to NASA, and compare their information with satellite data. The site also links to atmosphere, meteorology, climate teacher resources. <http://asd-www.larc.nasa.gov/SCOOOL>. (Available in most languages.)



## more NASA resources

**Spaceflight:** This site contains information on space station sightings, all manned missions, and astronauts. Find information, photographs and video at <http://spaceflight.nasa.gov>.

**NASA's Quest Project:** This site connects K-12 classrooms with people, research, and science through mission-based interactions and activities at <http://quest.nasa.gov/>.





Brought to you by the Teaching From Space Office

National Aeronautics and  
Space Administration

